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Supreme Court of the United States

OCTOBER TERM, 1982

METROPOLITAN EDISON COMPANY, *et al.*,
Petitioners,

v.

PEOPLE AGAINST NUCLEAR ENERGY, *et al.*,
Respondents.

UNITED STATES NUCLEAR REGULATORY COMMISSION AND THE UNITED STATES OF AMERICA,
Petitioners,

v.

PEOPLE AGAINST NUCLEAR ENERGY, *et al.*,
Respondents.

On Writs of Certiorari to the United States Court of Appeals for the District of Columbia Circuit

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BRIEF OF *AMICUS CURIAE* AMERICAN PSYCHOLOGICAL ASSOCIATION IN SUPPORT OF RESPONDENTS

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BRIEF OF *AMICUS CURIAE* AMERICAN PSYCHOLOGICAL ASSOCIATION IN SUPPORT OF RESPONDENTS

INTEREST OF *AMICUS CURIAE*

The American Psychological Association (APA), a nonprofit scientific and professional organization founded in 1892, is the major association of psychologists in the United States. The APA has more than 55,000 members and includes the vast majority of psychologists holding doctoral degrees from accredited universities in the United States.

One of APA's major functions has been to promote psychological research, to improve research methods, and to disseminate information regarding human behavior

through meetings, scientific publications and special reports. A substantial and growing number of APA's members, including over 500 of its members who belong to the Division of Population and Environmental Psychology, and 1400 who belong to the Division of Health Psychology are systematically studying the psychological effects of various environments.

In enacting the National Environmental Policy Act (NEPA) 42 U.S.C. 4321 et seq., at issue here, Congress acknowledged that unnecessary destruction of the natural environment would exact a heavy price from the citizens of this country in illness and "physical and psychological discomfort." Remarks of the bill's sponsor, Senator Henry Jackson, 115 Cong. Rec. 1785 (Feb. 18, 1969). The hope was expressed that the "powerful new tools" provided by the "natural and behavioral sciences" could be used to fashion sound environmental policy.[1] Thus, in NEPA, Congress expressly directed federal agencies to use an "interdisciplinary approach," utilizing "natural and social sciences," in carrying out their obligations under NEPA. 42 U.S.C.A. § 4332(2)(A).

One such obligation is the requirement that federal agencies include in every recommendation for a major Federal action "significantly affecting the quality of the human environment, a detailed statement by the responsible official on (i) the environmental impact of the proposed action [and] (ii) any adverse environmental effects which cannot be avoided should the proposal be implemented, . . ." 42 U.S.C. § 4332(2)(C)(i) and (ii) (1976). The legislative history of these provisions make it clear that Congress intended agencies to use information from natural and behavioral sciences to determine environmental effects adverse to the psychological as well as the physical health of Americans. As an association of behavorial scientists and clinicians, the APA wishes to inform the Court about psychological methods and data relevant to the legal issues in this case.

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[1] See also 40 CFR 1502.6 (1982).

Counsel for the parties have consented to the filing of this *amicus* brief. Their letters of consent have been filed with the Clerk.

INTRODUCTION AND SUMMARY OF ARGUMENT

At issue in this case is the refusal of the Nuclear Regulatory Commission (NRC) to receive and evaluate available information concerning the psychological harm which may be caused to area residents if the Reactor at Three Mile Island (TMI) is reactivated. The Court of Appeals held that NEPA requires the NRC to consider the psychological as well as the physical health effects of restarting the undamaged reactor at TMI.[2] The majority held that psychological effects are measurable, and that the severity of such effects is relevant to their cognizability under NEPA, and to whether a supplemental environmental impact statement is required.[3]

The NRC disagrees. It argues that NEPA does not require it to consider psychological effects of its actions unless those effects are caused by a change in the physical environment, which the NRC contends is not present at TMI.[4] The utilities, on the other hand, argue that NEPA does not require the NRC to consider any psychological effects, no matter how severe, resulting from its action, whether or not those effects are caused by changes in the physical environment.[5] Like Judge Wilkey, who dissented below, the utilities contend that effects of a restart on the psychological health of area residents cannot be measured or predicted and therefore cannot be weighed by the NRC.

As this brief will demonstrate, an understanding of the nature and causes of psychological harm confirms

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[2] *People Against Nuclear Energy v. United States Nuclear Regulatory Commission*, 678 F.2d 222 (D.C. Cir. 1982).

[3] *Id.* at 230.

[4] Brief for the United States and the United States Nuclear Regulatory Commission at 20, 27, 28 and 43 [hereinafter cited as "NRC Brief"].

[5] Brief for Petitioners Metropolitan Edison Company *et al.* at 18-24, [hereinafter cited as "Utilities Brief"].

that, with the exception of direct physical injuries to the brain (such as from infection or bullets) psychological injury results from a person's perception of his environment. Thus, if psychological health is cognizable at all under NEPA, as the NRC seems to acknowledge, it must necessarily include psychological health effects resulting from people's perception of changes in their physical environment. This brief will inform the Court about current research, data, and methods which are available to the Nuclear Regulatory Commission (NRC), to identify, quantify and predict the psychological health effects of environmental factors relevant in this case.

As *amici* will show, the severity of psychological impairment can be measured both in individuals and selected populations and can be estimated or predicted for groups of people. The APA submits that the damage to psychological health in the population surrounding TMI is sufficiently measurable and predictable to be weighed by the NRC in deciding whether a supplemental environmental impact statement is warranted and to be taken into account in a cost/benefit analysis of the restart. Thus, *amicus* supports respondents' position and the Court of Appeals' ruling that the NRC must consider psychological health effects as well as physical health effects of restarting the undamaged reactor.

ARGUMENT

I. CONGRESS INTENDED TO PROTECT PSYCHOLOGICAL HEALTH AS WELL AS PHYSICAL HEALTH UNDER THE NATIONAL ENVIRONMENTAL POLICY ACT.

A. One Of The Major Goals Of The National Environmental Policy Act Is The Protection Of Human Health.

Parties and *amicus* all agree that when it enacted NEPA Congress intended to protect human health.[6] The

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[6] 42 U.S.C. § 4331(b)(2) and (3), NRC Brief at 27; Utilities Brief at 20-21. And see Judge Wilkey's dissenting opinion below, 678 F.2d 222, 238 (D.C. Cir. 1982).

government and the utilities also agree that the NRC has an obligation under NEPA to assess the potential damage to human *physical* health which results from the presence of radiation in the reactor at TMI or which would occur if there were another nuclear accident.[7] Yet, Congress wisely framed the law in terms of health, not further qualified as physical or psychological.

Many lines of evidence have persuaded psychologists, physicians, and other health scientists that health (and its converse, illness or pathology) refers to the status of the whole person as a functioning unit. When the person is incapacitated, unable to work or to otherwise function effectively, we speak of her or him as having impaired health (or as being sick), regardless of the degree to which the state of altered adequacy has more obvious physical or psychological manifestations. Often the distressing symptoms of illness cannot easily be fitted into the neat constructs that the utilities rely upon with their insistence that health be split at some imaginary dividing line into the purely physical (which they accept as important) and the purely psychological (which they apparently regard as not truly real, unmeasurable, and unimportant).[8] *Amicus* disagrees and submits that health, including both its physical and psychological manifestations are protected by NEPA.

B. Psychological And Physical Health Are Interrelated Aspects Of Human Health.

The utilities' argument that psychological health effects are not covered by NEPA is not supported in the legislative history of NEPA. As the sponsor of NEPA, Senator Henry Jackson, stated when he introduced the bill: "The

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[7] NRC Brief at 29; Utilities Brief at 21.

[8] L. Millon, C. Green and R. Meagher, HANDBOOK OF CLINICAL HEALTH PSYCHOLOGY (1982); G. Stone, F. Cohen and N. Adler, HEALTH PSYCHOLOGY—A HANDBOOK (1979); L. Zegans, *Stress and the Development of Somatic Disorders*, in HANDBOOK OF STRESS, THEORETICAL AND CLINICAL ASPECTS (Goldberger and Breznitz 1982) (hereinafter cited as HANDBOOK OF STRESS).

purpose of this legislation is to lay the framework for a continuing program of research and study which will insure that present and future generations of Americans will be able to live in and enjoy an environment free of hazards to *mental and physical well being.*" (Emphasis added). 115 Cong. Rec. S. 1780 (Feb. 18, 1969).[9]

It has long been acknowledged that human health consists of both physical and psychological well being, and that the two are inseparable.[10] Increasingly, arbitrary distinctions between physical and psychological health are being replaced by acknowledgment that physical processes are influenced by psychological conditions, for example, as in gastric ulcers, and psychological processes are influenced by physical conditions, such as dementia associated with neurological disorders like Parkinson's disease.

II. THE IMPAIRMENT OF PSYCHOLOGICAL HEALTH CAN BE IDENTIFIED, MEASURED AND PREDICTED.

A. Psychology Is A Science Studying Human Cognition, Emotion And Behavior.

Psychology is the study of human cognition, emotion and behavior. It uses the approaches and methods of the natural sciences to generate knowledge about how and

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[9] A report to the Senate Interior Committee introduced into the *Congressional Record* by Senator Jackson stated that recent dangers created by advanced science and technology and related to misuse of the environment included "disability and death from disease induced by environmental factors (for example, cancer, emphysema and *mental disorders*)." (Emphasis added) 116 *Cong. Rec.* S. 1784 (Feb. 18, 1969).

[10] *See generally* Kellner, *Psychiatric Ill Health Following Physical Illness*, 112 BRITISH JOURNAL OF PSYCHIATRY 71 (1966); Nigro, *A Psychiatrist's Experiences in General Practice in a Hospital Emergency Room*, 214 JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION 1657 (1970). Several scientific professional journals are devoted to the specialty of psychosomatics; for example, PSYCHOSOMATIC MEDICINE, PSYCHOSOMATICS and JOURNAL OF PSYCHOSOMATIC RESEARCH.

why people react to aspects of their environment in certain ways. Psychology combines knowledge from biological, social, psychological and physical health perspectives and is concerned with the development of principles and procedures for understanding, predicting and influencing behavior. It has been recognized as a unique field of scientific endeavor for over one hundred years, since the founding of Wilhelm Wundt's psychology laboratory in Leipzig, Germany in 1879. Even before that, the foundations of scientific psychology were laid down by Fechner in 1860, with his seminal work, Elements of Psychophysics, quantifying subjective phenomena such as visual sensations. From its earliest beginnings, then, psychology has been developing scientific methods of quantifying such impalpables as perceptions and emotional states.

Psychological research has increased our ability not only to identify and quantify human responses to our environment, but also our ability to make predictions about human behavior and mental states. The psychologist is interested in identifying the "intervening variables" in the humans or animals under study which mediate between the initiating environmental event or stimulus and the behavioral response. When a person's environment presents a threat to his or her well-being, i.e., when a stressful event occurs, his or her resulting physical and emotional processes are the intervening variables which determine the person's behavioral response. The study of stress, then, is concerned with the identification and measurement of the effect of stressful events on psychological and physiological processes.

B. There Are Professionally Accepted Methods For Measuring The Effect Of Stressful Events On The Psychological Health Of Individuals.

The NRC Licensing Board and the Court of Appeals correctly found that psychological health effects caused

by stressful events such as those at TMI can be measured sufficiently to be considered by the NRC.[11] Contrary to the unsupported assertions of the Petitioners and dissenting Judge Wilkey, psychological health effects are not "ephemeral," "speculative" and "entirely subjective". To the contrary, psychological health effects can be measured in several ways, including quantitative subjective measures and objective physiological and biochemical measures.

Stress is an important determinant of all health and well being. The presence or threat of danger triggers defensive responses in people, involving physiological arousal (increased secretion of epinephrine, heightened cardiovascular response, increased respiration, etc.) and emotional changes as the person prepares to fight the threat or flee. The resulting emotional and physical states are called stress.

The body can cope with stress but this coping has costs.[12] Long-term exposure to a stressful event, or repeated adaptive demands can deplete the body's reserves and lead to physical and psychological dysfunction. This relationship between severe or chronic stress and ill health, both psychological and physical, is supported by the correlation among anxiety, depression, tension, diminished concentration ability, insomnia, stomach ulcers, headaches, skin disorders and suppressed immune reactions.[13]

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[11] 678 F.2d at 228-229; Certification to the Commission on Psychological Distress Issues by the Atomic Safety and Licensing Board, Feb. 22, 1980 LBP-80-8, 11 NRC 297 (1980) (Joint Appendix p. 36, note 8).

[12] R. Lazarus, PSYCHOLOGICAL STRESS AND THE COPING PROCESS (1966) [hereinafter cited as R. Lazarus], H. Selye, STRESS IN HEALTH AND DISEASE (1976); H. Seyle, *History and Present Status of the Stress Concept*, HANDBOOK OF STRESS.

[13] Note 10, *supra* and B. Dohrenwend, *infra* note 48.

Psychological variables play an important part in the interpretation of [14] and response to threatening events.[15] For example, psychological interpretations of environmental changes based on the subject's belief of his or her control of events influence corticosteroid secretion by the adrenal cortex.[16] In short, response to stressful events is determined by the degree to which an event is perceived as or believed to be threatening, harmful, or dangerous.[17] This belief depends on several factors, including attitudes toward the threat, prior experience with it, knowledge of its consequences, and evaluation of its apparent costs.

People respond not only to dangers that have materialized but also to threats, expectations or symbols of danger.[18] Anticipatory stress responses may last longer and ultimately be more damaging to the organism's health than the stressful event itself.

Evaluation of coping alternatives is also a crucial determinant of response to danger. Direct action responses occur when people try to manipulate or alter their relationship to the stressful situation. Thus, they may flee, attempt to destroy or remove the threat, or

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[14] J. Mason, *A Historical View of the Stress Field*, 22 JOURNAL OF HUMAN STRESS 22 (1975).

[15] A. Baum *et al.*, PSYCHOLOGICAL STRESS FOR ALTERNATIVES OF DECONTAMINATION OF THREE MILE ISLAND-2 REACTOR BUILDING ATMOSPHERE (USNRC Report 1980); S. Kasl & S. Cobb, VARIABILITY OF STRESS EFFECTS AMONG MEN UNDERGOING JOB LOSS, in HANDBOOK OF STRESS.

[16] *E.g.*, J. Singer, U. Lundberg and M. Frankenhaeuser, *Stress on the Train: A Study of Urban Commuting*, 1 ADVANCES IN ENVIRONMENTAL PSYCHOLOGY (A. Baum, J. Singer & S. Valins, eds., 1978). D. Glass & J. Singer, URBAN STRESS: EXPERIMENTS ON NOISE AND SOCIAL STRESSORS (1972).

[17] R. Lazarus, *supra* note 12 and K. Holroyd and R. Lazarus, STRESS, COPING AND SOMATIC ADAPTATION, in HANDBOOK OF STRESS.

[18] Wolf and Godell, STRESS AND DISEASE (1968).

in other ways change the external environment. When the subject believes that none of these is possible, defensive reactions may take place. Here, individuals accommodate to stressful situations by altering their "internal" environment—taking drugs, drinking, and using other defense mechanisms.[19]

There are four basic approaches to the measurement of psychological health effects of stressful events, and all have been used in studies at Three Mile Island: first, self-report measures which involve direct questioning of subjects about their feelings, beliefs, opinions and symptoms; second, behavioral measures which either record coping mechanisms or measure some ability or skill during or after exposure to the stressful event; third, psychophysiological assessments of the responses by one or more organ systems (*e.g.*, cardiovascular, respiratory); and finally, biochemical measures of endocrine response to stressful conditions.[20] These different approaches measure different aspects of the subject's response to stressful situations over differing time periods. Although each can be influenced by factors unrelated to stress, these factors can usually be controlled. Together they provide a useful picture of the interrelated psychological and biological aspects of human response to stressful situations.[21]

Self-report Measures

The easiest way to determine whether people are experiencing adverse psychological health effects is to ask them. Indeed, the central symptoms of many psychological disorders such as paranoia or obsessional neurosis are subjective: the best way to find out whether a man feels that people are persecuting him or whether a woman

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[19] R. Lazarus, *supra* note 12.

[20] A. Baum, N. Grunberg and J. Singer, *The Use of Psychological and Neuroendocrinological Measurements in the Study of Stress*, HEALTH PSYCHOLOGY (1982).

[21] *Id.*

is unable to carry on her daily life because she is preoccupied with distressing, unwanted thoughts, is to talk to each of them. The clinical interview therefore, has been the fundamental procedure of psychodiagnosis.

However, psychologists have discovered that written questions and answers save much time and they have long used written questionnaires for screening purposes. More recently, questionnaires have been refined and developed through statistical analysis and validation, so that today several such tests are in wide use, especially in large-sample research studies where individual interviewing might be prohibitively expensive. Generally, such questionnaires measure life events or experiences believed to be stressful,[22] emotional and somatic experiences associated with the event[23] or the aversiveness of the precipitating environmental conditions.[24] Economy, ease of ad-

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[22] This type of measure does not assess stress as a process involving events and responses to them. Instead, stress is inferred from the magnitude of diruption or adjustment believed to be associated with each event. These studies generally report evidence of an increase in life change preceding the onset of many illnesses. T. Holmes & M. Masuda, *Life Change and Illness Susceptibility*, in STRESSFUL LIFE EVENTS: THEIR NATURE AND EFFECTS (B. Dohrenwend & B. Dohrenwend, eds., 1974) [hereinafter cited as STRESSFUL LIFE EVENTS]; M. Jacobs, A. Spilken, A. Norman & L. Anderson, *Life Stress and Respiratory Illness*, 32 PSYCHOSOMATIC MEDICINE 233 (1970); R. Rahe, *Multi-cultural correlations of Life Change Scaling: America, Japan, Denmark and Sweden*, 13 JOURNAL OF PSYCHOSOMATIC RESEARCH 191 (1969).

[23] Emotional components of stress, such as anxiety, depression, alienation, and fear have been measured in many ways, including use of psychiatric inventories such as the Langer index or the Symptom Checklist-90. T. Langner, *A Twenty-two Item Screening Scale of Psychiatric Symptoms Indicating Impairment*, 3 JOURNAL OF HEALTH AND HUMAN BEHAVIOR 269 (1962); L. Derogatis, K. Rickels & A. Rock, *The SCL-90 and the MMPI: A Step In The Validation of a New Self-Report Scale*, 128 BRITISH JOURNAL OF PSYCHIATRY 280 (1976).

[24] R. Lazarus, *supra* note 12. R. Lazarus & R. Launier, *Stress-related Transactions Between Person and Environment*, INTERNAL

ministration, and validity are all strengths of interview or questionnaire assessments.

Behavioral Measures

Performance measures are generally less susceptible to biases than are self-report measures. Performance assessments are based on the finding that psychological disorders can affect the quality of performance on tasks attempted during or after exposure to stressful conditions.[25] These consequences are among the more fully researched aspects of stress.[26] For example, in several studies, researchers have found that subjects who had been exposed to stressful conditions performed more poorly on a proofreading task that required a great deal of concentration than did subjects exposed to less aversive condi-

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AND EXTERNAL DETERMINANTS OF BEHAVIOR (L. Pervin & M. Lewis, eds., 1978); R. Lazarus, J. Speisman, L. Davison, & A. Mordkoff, *A Laboratory Study of Psychological Stress Produced by a Motion Picture Film*, 76 PSYCHOLOGICAL MONOGRAPHS (1962).

One drawback of self-report approach is that a subject motivated to deceive can do so. For example, in the context of military induction, where attempts to simulate mental disorders are common, methods of distinguishing between genuine and faking self-reports have been developed—simulators generally lack accurate, detailed knowledge of the usual patterning of symptoms. For similar reasons, faked responses to self-report questionnaires or inventories can often be detected.

[25] Research has reported changes in performance among subjects given injections of "stress hormones" or catecholamines that generate arousal, *e.g.*, M. Frankenhaeuser & G. Jarpe, *Psychophysiological Changes During Infusions of Adrenaline In Various Doses*, 4 PSYCHOPHARMACOLOGIA 424 (1963); M. Frankenhaeuser, G. Jarpe & G. Mattel, *Effects of Intravenous Infusions of Adrenaline and Noradrenaline on Certain Physiological and Psychological Functions*, 51 ACTA PHYSIOLOGIA SCANDINAVIA 175 (1961), Wiley, *Human Stress and Cognition: An Information Processing Approach* (V. Hamilton and D. Warburton, eds. 1979).

[26] See S. Cohen, *Aftereffects of Stress on Human Performance and Social Behavior: A Review of Research and Theory*, 87 PSYCHOLOGICAL BULLETIN 578 (1980) for a review of these studies.

tions.[27] This difference in performance occurred after exposure to the stressful condition had been terminated, and apparently reflects a continuing cost of coping with it. Conditions other than stress can effect the performance of tasks, but these conditions can usually be controlled so that they do not influence the determination of the effects of stress.[28]

Physiological Changes

Many researchers studying the relation between environmental events and health describe a mediating chain of events in which stress produces physiological strains, which in turn may result in illness. Measurement of physiological strains often assesses arousal associated with the non-voluntary or sympathetic nervous system. Some investigators consider the startle response to be a prototype of arousal with its increases in heart rate, respiration, blood pressure, and cardiac stroke volume.[29] Measurements of sympathetic nervous system arousal have been used to indicate stress in several different research settings.[30] Heart rate, respiration rate, pulse wave velocity,

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[27] D. Glass and J. Singer, URBAN STRESS: EXPERIMENTS ON NOISE AND SOCIAL STRESSORS (1972).

[28] For example, copy editors or other educated people would do better on proofreading tasks than less educated people, independent of the stress factor. However, truly random samples drawn from the similar experimental and control populations would result in each group having the same proportion of educated subjects. Correlations between education levels and performance levels for the experimental and control groups permit comparisons between the performance of the educated subgroups of each. Differences in their performances, then, would have to be attributed to some factor other than education.

[29] P. Lang, D. Rice, and R. Sternbach, *The Psychophysiology of Emotion*, HANDBOOK OF PSYCHOPHYSIOLOGY (N. Greenfield & R. Sternbach, eds., 1972).

[30] *E.g.*, S. Cohen, G. Evans, D. Krantz, & D. Stokols, *Physiological, Motivational and Cognitive Effects of Aircraft Noise on Children: Moving From the Laboratory to the Field*, 35 AMERICAN PSYCHOLOGIST 231 (1980); P. Paulus, G. McCain, & V. Cox, *Death Rates*,

and other measures have been found to be adversely affected by crowding, anger or fear, pain, and viewing gruesome films.[31]

Biochemical Changes

Part of the pathological process of environmentally induced impairments of health is an alteration in the delicate biochemical balance of the human body. Exposure to stressful events causes changes in levels of various hormones in blood or urine samples.[32] Secretion of cortiocosteroids by the adrenal cortex and of catecholamines by the adrenal medulla have been related to a variety of stressful psychosocial stimuli.[33]

Psychiatric Commitments, Blood Pressure and Perceived Crowding as a Function of Institutional Crowding, 3 ENVIRONMENTAL PSYCHOLOGY AND NONVERBAL BEHAVIOR 107 (1978).

[31] *E.g.*, A. Ax, *The Psychological Differentiation Between Fear and Anger in Humans*, 15 PSYCHOSOMATIC MEDICINE 433 (1953); R. Lazarus, J. Speisman, A. Mordkoff, & L. Davison, *supra*, note 24. S. Schachter, *Pain, Fear and Anger in Hypertensives and Normotensives: A Psychophysiologic Study*, 19 PSYCHOSOMATIC MEDICINE 17 (1957). Like the others, physiological measures have some limitations, but they can usually be accommodated. Blood pressure, for instance, may fluctuate significantly in the same subject over short periods of time and is affected by non-stress related factors such as exercise and position of the body. However, the effect of these factors can be eliminated by averaging repeated readings and by identifying non-stress factors and correlating them with blood pressure, so that similar control and non-control subgroups can be compared to determine the effect of the remaining independent variable-stress.

[32] M. Frankenhaeuser, *Sympathetic-adrenomedullary Activity, Behavior and the Psychosocial Environment*, RESEARCH IN PSYCHOPHYSIOLOGY (P. Venables & M. Christie, eds., 1975); J. Mason, *A Historical View of the Stress Field, Journal of Human Stress* 22 (1975); H. Selye, THE STRESS OF LIFE (1976).

[33] Psychological influences on the hypothalamic-pituitary-adrenal cortex axis, which regulates corticosteroid secretion, is among the most extensively studied endocrine system, and substantial evidence of psychosocial determination of adrenal cortical activity has been reported. A. Baum, *supra*, note 20.

Early stress research demonstrated that animals exposed to danger showed adrenal cortical enlargement and had higher levels of circulating corticosteroids.[34] Studies with human subjects also have linked increased adrenal cortical activity to stressful conditions such as crowding, athletic competition, changes in surroundings, loss of control, emergency duty in hospitals, and airplane flights.[35] Research has fairly well established that 17-hydroxycorticosteroids (17-OHCS), primary cortisol, are reliable indicators of stress,[36] and assays of both blood and urinary 17-OHCS have been perfected for the study of this relationship.[37]

Measurement of catecholamines has also proven to be a useful biochemical measure of stress.[38] Secreted by the adrenal medulla rather than by the adrenal cortex,

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[34] See *e.g.*, F. Elmadjian & G. Pincus, *The Adrenal Cortex and the Lympho-cytopenia of Stress*, 37 ENDOCRINOLOGY 47 (1945); L. Herrington & J. Nelbach, *Relation of Gland Weights to Growth and Aging Processes in Rats Exposed to Certain Environmental Conditions*, 30 ENDOCRINOLOGY 375 (1942). J. Christian, *The Pathology of Overpopulation*, 128 MILITARY MEDICINE 571 (1963).

[35] *E.g.*, J. Davis, R. Morrill, J. Fawcett, V. Upton, D. Bondy, & H. Spiro, *Apprehension and Elevated Serum Cortisol Levels*, 6 JOURNAL OF PSYCHOMATIC RESEARCH 82 (1962); J. Frost, R. Dryer, & K. Kohlstaedt, *Stress Studies on Auto Race Drivers*, 38 JOURNAL OF LABORATORY AND CLINICAL MEDICINE 523 (1951); J. Mason, *supra*, note 14.

[36] *E.g.*, E. Bliss, C. Migeon, C. Branch, & L. Samuels, *Reaction of the Adrenal Cortex to Emotional Stress*, 18 PSYCHOSOMATIC MEDICINE 56 (1956).

[37] *E.g.*, J. Mason, *supra*, note 14; R. Rose & J. Mason, *Psychological State and Body Size as Determinants of 17-OHCS Excretion*, 121 ARCHIVES OF INTERNAL MEDICINE 406 (1968); C. Wolff, S. Friedman, M. Hofer, & J. Mason, *Relationship Between Psychological Defenses and Mean Urinary 17-OHCS Excretion Rates: A Predictive Study of Parents of Fatally Ill Children*, 26 PSYCHOSOMATIC MEDICINE 576 (1964)).

[38] M. Frankenhaeuser and G. Johansson, *Task Demand as Reflected in Catecholamine Excretion and Heart Rate*; JOURNAL OF HUMAN STRESS (1976).

catecholamines are an important element in the involuntary process of arousal. Thus, one would expect states of hypervigilance and related increases in catecholamines to accompany episodes of stress.[39] Research has confirmed this expectation, linking increased secretion of epinephrine and norepinephrine to such conditions as pain, lack of oxygen, crowding, and extreme temperatures as well as situations involving failure, threat, and uncertainty.[40] Researchers have also found that having control or the perception of control over aversive events reduced catecholamine response to these events. For instance, studies indicate that perceived control is associated with lower levels of catecholamines in response to noise and to crowding.[41]

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[39] Catecholamine levels vary as a function of factors other than stress such as exercise, coffee, etc. The effect of these factors can and should be eliminated if such levels are to be used as a reliable and valid measurement of arousal. J. Brohut, L. Levi and H. Reichard, *Urinary Excretion of Adrenal Cortical and Medullary Hormones*, ACTA MEDICA SCANDINAVIA, (1970). L. Levi, *The Effect of Coffee on the Function of the Sympathoadrenomedullary System in Man*, 181 ACTA MEDICA SCANDINAVIA 431 (1967).

[40] *E.g.*, M. Frankenhaeuser, *Experimental Approaches to the Study of Catecholamines and Emotion*, 392 REPORTS FROM THE PSYCHOLOGICAL LABORATORIES, UNIVERSITY OF STOCKHOLM (1973); M. Frankenhaeuser, B. Nordeheden, A. Myrsten & B. Post, *Psychophysiological Reactions to Understimulation and Overstimulation*, 35 ACTA PSYCHOLOGIA 298 (1971); L. Levi, *Stress and Distress in Response to Psychosocial Stimuli. Laboratory and Real Life Studies on Sympathoadrenomedullary and Related Reactions*, ACTA MEDICA SCANDINAVIA SUPP. 528 (1972).

[41] *E.g.*, U. Lundberg & M. Frankenhaeuser, *Adjustment to Noise Stress*, 484 REPORTS FROM THE DEPARTMENT OF PSYCHOLOGY, UNIVERSITY OF STOCKHOLM (1976); U. Lundberg & M. Frankenhaeuser, *Psychophysiological Reactions to Noise as Modified by Personal Control Over Noise Intensity*, 6 BIOLOGICAL PSYCHOLOGY 51 (1978). J. Singer, U. Lundberg, M. Frankenhaeuser, *Stress on the Train: A Study of Urban Commuting*, 1 ADVANCES IN ENVIRONMENTAL PSYCHOLOGY (A. Baum, J. Singer, and S. Valins, eds., 1978).

Each of the four kinds of measures discussed here produces information about the organismic process initiated by a threatening environmental event and culminating in a breakdown in health. Although each of the measures has limitations and can be affected by factors other than stressful events, these factors can usually be controlled. Findings indicating stress on several measures strongly support the conclusion that psychological and physiological health effects of stress are present and being measured. Therefore, it is desirable to use as many measures as possible when studying the health effects of events such as those being litigated here.

C. There Are Professionally Accepted Methods For Measuring The Effect Of Stressful Events On The Psychological Health Of Selected Populations.

Epidemiological studies of the effect of stressful conditions are conducted by using the measures discussed above. Like epidemiological studies of physical characteristics, psychological epidemiology studies the prevalence of psychological characteristics in certain groups.[42] These studies record the psychological condition of individual subjects who are randomly selected from the population under study in sufficient numbers to constitute a statistically sound representative sample. Standardized tests are administered to the subjects by trained personnel to determine psychological characteristics. These tests may also be administered at specified intervals in order to measure changes over time.

Where a study is undertaken to determine the effect of an event on the psychological health of a selected population, it is necessary to have comparable information for the same population before the event or to have comparable information for similar or "control" populations which have not experienced the stressful event. Questionnaires gather information on demographic charac-

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[42] M. Weissman and G. Klerman, *Epidemiology of Mental Disorders*, 35 ARCHIVES OF GENERAL PSYCHIATRY 705 (1978).

teristics of the sample—age, sex, race, education, occupation, etc.—as well as information on stressful work conditions, personal mental health history, current psychological symptoms and social supports available to mitigate effects of stress (family, friends, social organizations, etc.). These data are used to establish the characteristics necessary to select a control group.

By means of statistical analysis the psychologist can determine groups of variables that cluster and define subgroups of the sample, such as those subjects suffering neurotic anxiety or depression. Studies of the effect on the psychological health of survivors of various disasters such as tornadoes, and flooding can be conducted in this manner.[43] This kind of epidemiological study has been conducted at Three Mile Island and will be discussed below.

D. There Are Professionally Accepted Methods For Estimating The Effect Of Future Stressful Events On Psychological Health.

Not only does psychology study and measure existing psychological characteristics, psychology has as one of its goals the prediction of future behavior. Psychologists have been quite successful in predicting collective human behavior, such as voting patterns in elections, academic grades in college, and consumer behavior.[44] Prediction of future behavior depends upon an understanding of the relationship between specific antecedent conditions and behavioral responses in the past.

Psychological research, particularly research into the psychological effects of exposure by combat soldiers to

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[43] See generally K. Erikson, EVERYTHING IN ITS PATH: DESTRUCTION OF COMMUNITY IN THE BUFFALO CREEK FLOOD (1976); A. Barton, COMMUNITIES IN DISASTER (1972); R. Perry and M. Lindell, *The Psychological Consequences of Natural Disasters*; in MASS EMERGENCIES (1978); E. Quarantelli and R. Dynes, *Response to Social Crisis and Disaster*, ANNUAL REVIEW OF SOCIOLOGY (1977).

[44] R. Holt, METHODS IN CLINICAL PSYCHOLOGY; PREDICTION AND RESEARCH (1978).

extreme danger and near misses, supports the theory that people who are faced with severe threats to their physical safety, though they may not be injured or even touched, generally acquire a marked increase in sensitivity to similar threatening stimuli in the future. The concept of sensitization applies to instances in which people once traumatized by a frightening experience show signs of unusually high arousal upon the presentation of formerly neutral stimuli now associated with the traumatic experience.

The arousal and psychological distress exhibited by near miss victims can be explained as a new sense of vulnerability—a realization that injury and death are real possibilities or probabilities to be warded off and defended against. They can also be explained as examples of learned or conditioned emotional response—emotional arousal resulting from reexperiencing the fear-evoking stimuli. On the whole, people who have near-miss experiences have more intense emotional distress when the same danger is threatened again than will people who have never experienced the threat or a near miss.[45]

III. THE NRC WILL NOT BE UNDULY BURDENED BY A REQUIREMENT THAT IT EVALUATE INFORMATION CONCERNING PSYCHOLOGICAL HEALTH EFFECTS OF RESTARTING THE TMI REACTOR.

A. The Lower Court Held Only That NEPA Requires The NRC To Evaluate Information Concerning Psychological Health Effects Of Restarting The TMI Reactor In Order To Determine Whether A Supplemental Environmental Impact Statement Should Be Prepared.

Before a determination can be made whether psychological health effects can be measured sufficiently to be considered by the NRC, it is necessary to understand

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[45] I. Janis, G. Mahl, J. Kagan, and R. Holt, PERSONALITY: DYNAMICS, DEVELOPMENT, AND ASSESSMENT, pp. 64-92 (I. Janis ed. 1969).

for what purpose the Court of Appeals ordered the NRC to consider such information.

The Court of Appeals' decision is narrow in several respects. First, contrary to suggestions by the petitioners, neither the explicit language nor the rationale of the decision require an assessment of the psychological impact of all or even many major federal actions. The Court of Appeals addressed itself only to NEPA requirements where allegations have been made that severe adverse psychological health effects accompanied by physical symptoms have already occurred and will be exacerbated if the NRC authorizes restart of the undamaged reactor. The NRC itself has interpreted the decision to apply only where such health effects have been caused by a nuclear accident—*i.e.*, only at Three Mile Island.[46]

Second, the Court of Appeals did not require the NRC to prepare a "supplemental environmental impact statement" (EIS) estimating the psychological impact of a decision to restart the reactor at TMI. It did not even require the NRC to undertake a preliminary "environmental assessment" of the psychological effects of the proposed TMI restart. The Court required only that the NRC adopt procedures for the consideration of currently available information on the psychological health effects of a restart in order to determine whether a supplemental EIS should be prepared.

Finally, even if the NRC were to find that currently available psychological information warrants preparation of a supplemental EIS, *and* if it were to find that the restart would have a harmful effect on the psychological health of area residents, the NRC is not required by the decision below to deny the utility permission to restart the reactor. As with all agencies subject to NEPA, the NRC is required by the Act only to weigh the environmental effects of its actions—not to let

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[46] United States Nuclear Regulatory Commission, Policy Statement: Consideration of Psychological Stress Issues, July 16, 1982.

such effects determine its action.[47] The Court of Appeals' decision in this case requires no more. Furthermore, the NRC has discretion to grant permission to restart the reactor on the condition that efforts be made to mitigate the adverse psychological health effects restart may have.

B. Existing Studies Of The TMI Population Provide Valuable Information Concerning The Psychological Health Of TMI Residents.

Existing data already collected on the TMI population and available to the NRC provide valuable information concerning psychological health there and the likelihood of further psychological harm if the reactor is restarted. Because the accident at TMI was unexpected, researchers did not have the opportunity to design studies involving baseline psychological evaluations at TMI prior to the incident. Therefore, stress evaluations of a demographically similar population living around another nuclear site were used by some researchers to establish the necessary baseline. A variety of measurement techniques and assessment devices were used to evaluate psychological health at TMI, and the findings from different studies are in substantial agreement regarding the psychological health effects of the incident there.[48] For example, the Presi-

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[47] *Kleppe* v. *Sierra Club*, 427 U.S. 390 (1976); *Strycker's Bay Neighborhood Council, Inc.* v. *Karlen*, 444 U.S. 223 (1980).

[48] A. Baum *et al.*, CHRONIC AND ACUTE STRESS ASSOCIATED WITH THREE MILE ISLAND ACCIDENT AND DECONTAMINATION, PRELIMINARY FINDINGS OF A LONGITUDINAL STUDY (Draft report submitted to USNRC, 1981); A. Baum *et al.*, PSYCHOLOGICAL STRESS FOR ALTERNATIVES OF DECONTAMINATION OF THREE MILE ISLAND-2 REACTOR BUILDING ATMOSPHERE (USNRC Report 1980); E. Bromet and L. Dunn, *Mental Health of Mothers Nine Months After the Three Mile Island Accident*, 14 URBAN AND SOCIAL CHANGE REVIEW 12 (1981); E. Bromet *et al.*, PRELIMINARY REPORT ON THE MENTAL HEALTH OF THE THREE MILE ISLAND RESIDENTS (1980); E. Bromet, H. Schulberg and L. Dunn, *Reactions of Psychiatric Patients to the Three Mile Island Nuclear Accident*, ARCHIVES OF GENERAL PSYCHIATRY (in press); E. Bromet *et al.*, THREE MILE ISLAND: MENTAL HEALTH FINDINGS (NIMH Contract #278-79-0048(SM) 1980); R.

Chisholm and S. Kasl, *The Effects of Work Site, Supervisory Status, and Job Function on Nuclear Workers' Responses to the TMI Accident*, JOURNAL OF OCCUPATIONAL BEHAVIOR (in press); R. Chisholm *et al.*, *Behavioral and Mental Health Effects of the TMI Accident on Nuclear Workers: A Preliminary Report*, 365 ANNALS OF THE NEW YORK ACADEMY OF SCIENCES 134 (1981); B. Dohrenwend *et al.*, REPORT OF THE TASK GROUP ON BEHAVIORAL EFFECTS, STAFF REPORTS TO THE PRESIDENT'S COMMISSION ON THE ACCIDENT AT THE THREE MILE ISLAND (U.S.G.P.O. 257-308, 1979); C. Flynn, THREE MILE ISLAND TELEPHONE SURVEY, PRELIMINARY REPORT ON PROCEDURES AND FINDINGS (USNRC, 1979); M. Goldhaber, P. Houts, R. DiSabella, MOBILITY OF THE POPULATION WITHIN 5 MILES OF THREE MILE ISLAND DURING THE PERIOD FROM AUGUST 1979 THROUGH JULY 1980 (Report to TMI Advisory Panel on Health Research Studies of the Pa. Dept. of Health, 1981); Governor's Office of Policy Planning, THE SOCIO-ECONOMIC IMPACTS OF THE THREE MILE ISLAND ACCIDENT: FINAL REPORT (1980); P. Houts & M. Goldhaber, *Psychological and Social Effects on the Population Surrounding TMI After the Nuclear Accident on March 28, 1979*, in ENERGY, ENVIRONMENT AND THE ECONOMY (S. Majumdar ed., 1981); P. Houts *et al.*, HEALTH-RELATED BEHAVIORAL IMPACT OF THE THREE MILE NUCLEAR INCIDENT PARTS I AND II (Report to TMI Advisory Panel on Health Research Studies of the Pa. Dept. of Health, 1980); P. Houts *et al.*, HEALTH RELATED BEHAVIORAL IMPACT OF THE THREE MILE ISLAND NUCLEAR INCIDENT PART III, (Report to TMI Advisory Panel on Health Research Studies of the Pa. Dept. of Health, 1981); P. Houts, R. DiSabella, M. Goldhaber, *Extent and Duration of Psychological Distress of Persons in the Vicinity of Three Mile Island*, 54 PROCEEDINGS OF THE PENNSYLVANIA ACADEMY OF SCIENCES 22 (1980); T. Hu *et al.*, HEALTH-RELATED ECONOMIC COSTS OF THE THREE MILE ISLAND ACCIDENT (Report submitted to TMI Advisory Panel on Health Research Studies of the Pa. Dept. of Health 1981); S. Kasl, R. Chisholm and B. Eskenazi, *The Impact of the Accident at the Three Mile Island on the Behavior and Well-Being of Nuclear Workers: Part I Perceptions and Evaluations, Behavioral Responses and Work-Related Attitudes and Feelings*, 71 AMERICAN JOURNAL OF PUBLIC HEALTH 472 (1981); S. Kasl, R. Chisholm and B. Eskenazi, *The Impact of the Accident at the Three Mile Island on the Behavior and Well-Being of Nuclear Workers: Part II. Job Tension, Psychophysiological Symptoms, and Indices of Distress*, 71 AM. J. OF PUBLIC HEALTH 484 (1981); J. Morell & G. Spivak, REVIEW OF STUDIES ON THE PSYCHOLOGICAL AND BEHAVIORAL IMPACT OF THE TMI NUCLEAR ACCIDENT, WITH SPECIFIC IMPLICATIONS FOR RESEARCH AND PLANNING (Dept. of Mental Health Sciences, Hahnemann Medical College, unpublished 1980).

dent's Commission on the Accident at Three Mile Island reported that the major health effect of the accident was upon the mental health of workers and residents of the area.[49]

Similarly, epidemiological research undertaken at TMI to determine the psychological effects of the accident reported elevated levels of anxiety and depression there. This research studied the population over time with appropriate control groups, and standardized methods for assessing psychological reactions. Three groups were selected for study—mothers of young children, workers at the TMI plant, and individuals who had used public mental health facilities in the previous six months. The study found that mothers

> "[H]ad an excess risk of experiencing clinical episodes of anxiety and depression during the year after the accident. These clinical episodes were not associated with other stress and support factors. TMI mothers also reported more symptoms of anxiety and depression at subclinical levels at both interview times compared to [the control] mothers. . . . Being pregnant at the time of the accident also was an important risk factor".[50]

Other studies of the general population around TMI also recorded elevated stress responses (*e.g.*, agitation, sleep disturbances, digestive upset) in the time period immediately following the TMI accident.[51] Although the

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[49] The President's Commission on the Accident at Three Mile Island, THE NEED FOR CHANGE: THE LEGACY AT TMI, 35 (1979).

[50] E. Bromet, THREE MILE ISLAND: MENTAL HEALTH FINDINGS, 76 (NIMH Contract #278-79-0048, 1980). No significant effects were found for nuclear plant workers and mental health clients when compared with the control group.

[51] *E.g.*, B. Dohrenwend *et al.*, *supra*, note 48; S. Kasl, R. Chisholm & B. Eskenazi, *The Impact of the Accident at the Three Mile Island on the Behavior and Well-Being of Nuclear Workers: Part II. Job Tension, Psychophysiological Symptoms, and Indices of Distress*, 71

general prevalence of acute symptoms dissipated over time, it remained significantly detectable more than a year later.[52] Mothers of young children continued to evidence symptoms with greater severity and frequency than the general population.[53] Similarly, people living in close proximity to the reactor evidenced more symptoms. Finally, there is evidence that the affected population has a high and continuing distrust of public officials, and that belief in the dangers of nuclear power is associated with greater stress reactions.[54]

Strong confirmation of the above results was found in a later study on the effects of the venting of krypton gas at TMI.[55] People who had lived through the previous TMI incident showed significant stress in anticipation of the venting, and while the stress level decreased over time following the venting, it nevertheless remained significantly higher than that of a control group. These heightened reactions can be explained as the reactions of residents sensitized by the accident in the reactor. In addition, perceptions of nuclear threat and mistrust of public officials associated with stress reactions continued to remain high.

AM. J. OF PUBLIC HEALTH 484 (1981); P. Houts and M. Goldhaber, *Psychological and Social Effects on the Population Surrounding TMI After the Nuclear Accident on March 28, 1979*, in ENERGY, ENVIRONMENT AND THE ECONOMY (S. Majumadar ed. 1981).

[52] P. Houts & M. Goldhaber, *supra*, note 51; E. Bromet *et al.*, PRELIMINARY REPORT ON THE MENTAL HEALTH OF THE THREE MILE ISLAND RESIDENTS (1980); E. Bromet *et al.*, THREE MILE ISLAND: MENTAL HEALTH FINDINGS (NIMH Contract #278-79-0048 (SM) (1980); E. Bromet & L. Dunn, *Mental Health of Mothers Nine Months After the Three Mile Island Accident* 14 URBAN AND SOCIAL CHANGE REVIEW 12 (1981).

[53] E. Bromet & L. Dunn, *supra*, note 52.

[54] B. Dohrenwend *et al.*, *supra*, note 48; P. Houts and M. Goldhaber, *supra*, note 51.

[55] A Baum *et al.* (1981), *supra*, note 48; A. Baum *et al.* (1980), *supra*, note 48.

The Court of Appeals' decision requires the NRC, not *amicus* or parties to this action, to evaluate the significance of new psychological information relevant to the restart decision. Nevertheless, *amicus* note that existing data indicate that restart could have an adverse effect on the psychological health of the TIM population. Restart of TMI-1 will result in a change in the physical environment of Three Mile Island, i.e., the presence of a nuclear reaction and radiation which was not there before the restart. Although the radiation is assumed to be contained within the reactor building, its new presence in the environment can be perceived by residents as a threat to their physical health, because, based on their experience with the TMI-2 accident, they know it can become uncontrolled. Thus, data collected on the residents' responses to the TMI-2 accident are highly relevant to the restart of TMI-1. Residents of the area surrounding the TMI nuclear reactors experienced a near miss disaster and fear for their physical safety when the TMI-2 accident occurred. Studies show that they experienced psychological and physiological arousal as a result. Sensitization research indicates that the residents have thus been sensitized or conditioned to experience abnormally severe fear as well as the physiological and behavioral manifestations of such fear when a similar disaster is threatened or made more likely, as it would be if TMI 1 is restarted.

In addition, much has been learned in recent years about the relationship between attitudes and behaviors which would be helpful in predicting effects of TMI-1 restart based on currently held beliefs and attitudes.[56]

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[56] I. Ajzen, & M. Fishbein, *Attitude-Behavior Relations: A Theoretical Analysis and Review of Empirical Research*, 84 PSYCHOLOGICAL BULLETIN 888 (1977); I. Ajzen & M. Fishbein, UNDERSTANDING ATTITUDES AND PREDICTING SOCIAL BEHAVIOR (1980); Davidson & Jaccard, *Variables That Moderate the Attitude-Behavior Relation: Results of a Longitudinal Survey*, 37 JOURNAL OF PERSONALITY AND SOCIAL PSYCHOLOGY 1364 (1979), Fazio and Zanna, *Direct Experi-*

Recent studies have shown that attitudes based on direct experience, like those of the TMI population, predict behaviors better than attitudes not based on direct experience. Research also indicates that anticipation of a restart could lead to significant stress reactions, especially for those living in close proximity to the reactor itself.[57]

C. Further Studies Of Psychological Health Effects At TMI Could Be Undertaken By The NRC Quickly And Inexpensively.

Although existing data on the psychological health effects of the TMI accident provide a substantial basis for estimating the effects of a decision to restart the undamaged reactor, additional data useful to predicting those effects could be gathered relatively easily by the NRC.[58] For example, the raw data collected for existing studies could be analyzed to determine whether the psychological health effects are mild for a large number of people or severe for a few, or both. Similarly, existing data could be analyzed to determine whether there are groups other than young mothers and proximate residents who run a high risk of being adversely affected. Follow-up studies could be undertaken to better determine the prevalence of chronic stress at TMI and its disabling effects. Finally, further information concerning the correlation between attitudes and beliefs about the safety of nuclear power and psychological health effects could be gathered in order to better estimate the future vulnerability and specific symptomatology of persons holding such beliefs.[59]

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ence and Attitude-Behavior Consistency, 14 ADVANCES IN EXPERIMENTAL SOCIAL PSYCHOLOGY (L. Berkowitz, ed., 1981).

[57] A. Baum *et al.* (1981), *supra*, note 48.

[58] P. Walker, W. Fraize, J. Gordon and R. Johnson, PROCEEDINGS OF THE WORKSHOP ON PSYCHOLOGICAL STRESS ASSOCIATED WITH THE PROPOSED RESTART OF THREE MILE ISLAND UNIT 1, 47-74 (1982) (hereinafter cited as *Proceedings*).

[59] Dr. Robert R. Holt has outlined one study that could be easily done, based on the relationship between attitudes and symptoms in a sample of current TMI residents. *Proceedings* at 76.

Because much of the existing raw data would be useful and several methods for the collection of additional data have already been developed, none of these additional studies should take more than a few months to complete. CEQ regulations require the NRC to obtain information relevant to adverse impacts of its actions which are essential to reasoned choice among alternatives if the overall costs of obtaining that information are not exorbitant. 40 CFR 1502.22. In addition, further information concerning stress symptoms would be useful to the NRC when it considers what actions, if any, are needed to mitigate adverse psychological health effects at TMI.

IV. IMPAIRMENTS OF PSYCHOLOGICAL HEALTH EXPERIENCED BY RESIDENTS OF THE TMI AREA IN CONNECTION WITH THE RESTART OF TMI-1 CAN BE SIGNIFICANTLY ALLEVIATED THROUGH THE USE OF STRESS MANAGEMENT TECHNIQUES.

As noted, the Court of Appeals' decision merely requires the NRC to adopt procedures to consider information about the psychological health effects of the TMI restart, in order to determine whether a supplemental EIS is warranted. *Amicus* believes that if the NRC orders the preparation of such a statement, it could lead to efforts to alleviate the psychological distress suffered by TMI area residents. The NRC could, in its discretion, encourage the use of therapeutic techniques at TMI that have proven reliable and effective in reducing stress in other situations.[60]

Studies have demonstrated that advanced preparation for an anxiety-producing event through appropriate presentation of relevant information and structured

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[60] *Calvert Cliffs Coord. Com. v. United States Atomic Energy Commission*, 449 F.2d 1109, 1128 (D.C. Cir. 1971); *Environmental Defense Fund* v. *Corps. of Engineers*, 492 F.2d 1123, 1135 (5th Cir. 1974); and see 40 CFR §§ 1500.2(a), (e) and (f); *In Matter of Metropolitan Edison Company*, 11 NRC 297, 307-309 (1980).

coping strategies significantly reduces anticipatory anxiety, decreases stress and perceived discomfort.[61]

In addition to such information programs group therapy programs could be established at community mental health centers or at other treatment facilities. People who experience a high degree of anxiety about the TMI restart could be offered the opportunity to enroll in these groups. Therapeutic groups can use several effective techniques to assist in the management of stress, including desensitization [62] and relaxation [63] techniques.[64]

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[61] Egnert, Battit, Welch & Bartlesa, *Reduction of Post-Operative Pain By Encouragement and Instruction of Patients*, 270 NEW ENGLAND JOURNAL OF MEDICINE 825 (1964); Langer, Janis & Wolfer, *Reduction of Psychological Stress in Surgical Patients*, 11 JOURNAL OF EXPERIMENTAL SOCIAL PSYCHOLOGY 155 (1975); B. Melamed & G. Siegel, BEHAVIORAL MEDICINE (1980). Public information and therapy programs have been used to fight cardiovascular disease, in programs such as the Stanford Heart Disease Prevention Program. Meyer, Nash, McAlister, Macoby & Farquhar, *Skills Training in Cardiovascular Health Education Campaigns*, 48 JOURNAL OF CONSULTING AND CLINICAL PSYCHOLOGY 129 (1980); Hollis, Connor & Matarazzo, LIFESTYLE BEHAVIORAL HEALTH, AIND HEART DISEASE, BEHAVIORAL MEDICINE AND CLINICAL PSYCHOLOGY: OVERLAPPING AREAS (R. Gatchel, A. Baum, & J. Singer, eds., 1982).

[62] See J. Wolpe, THE PRACTICE OF BEHAVIOR THERAPY (1969).

[63] See E. Jacobsen, PROGRESSIVE RELAXATION (1938) for the pioneering study in this field.

[64] Behavioral and other psychological approaches have been used to treat anxiety; R. Gatchel, *Comparative Effectiveness of Group Administered Desensitization in an Education/Discussion Group Procedure in Reducing Dental Fear*, 101 JOURNAL OF THE AMERICAN DENTAL ASSOCIATION 634 (1980); J. Wolpe, THE PRACTICE OF BEHAVIOR THERAPY (1969); asthma: Creer, Asthma, 50 JOURNAL OF CONSULTING AND CLINICAL PSYCHOLOGY 912 (1982); depression, A. Beck, COGNITIVE THERAPY AND THE EMOTIONAL DISORDERS (1976); epilepsy, Sterman and Friar, *Suppression Of Seizures In An Epileptic Following Sensorimotor EEG Feedback Training*, 33 ELECTROENCEPHOLOGY AND CLINICAL NEUROPHYSIOLOGY 89 (1972); gastrointestinal disorders, Whitehead and Bosmajian, *Behavioral Medicine Approaches To Gastrointestinal Disorders*, 50 JOURNAL OF CON-

These relaxation and stress management techniques can be provided at a relatively low cost per individual in groups with as many as fifteen or twenty individuals in each group.

Accordingly, if the NRC concludes that restart of TMI reactor will cause serious psychological health effects in the surrounding population, it has a variety of methods available for its consideration that offer the potential for significantly reducing the detrimental psychological impact of restarting the TMI reactor.

CONCLUSION

The judgment below should be affirmed.

Respectfully submitted,

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SULTING AND CLINICAL PSYCHOLOGY 976 (1982); headaches, Blanchard and Andrasik, *Psychological Assessment and Treatment of Headache: Recent Developments and Emerging Issues*, 50 JOURNAL OF CONSULTING AND CLINICAL PSYCHOLOGY 859 (1982); and sleep disorders, Burkovec, *Insomnia*, 50 JOURNAL OF CONSULTING AND CLINICAL PSYCHOLOGY 880 (1982). See generally R. Gatchel & A. Baum, INTRODUCTION TO HEALTH PSYCHOLOGY (1983).